Technology

Implant lets people type on virtual keyboards with just brain signals

A company called Synchron, backed by Bill Gates and Jeff Bezos, may become the first to commercialise a brain implant that lets people control touchscreen devices using brain signals

By Jeremy Hsu

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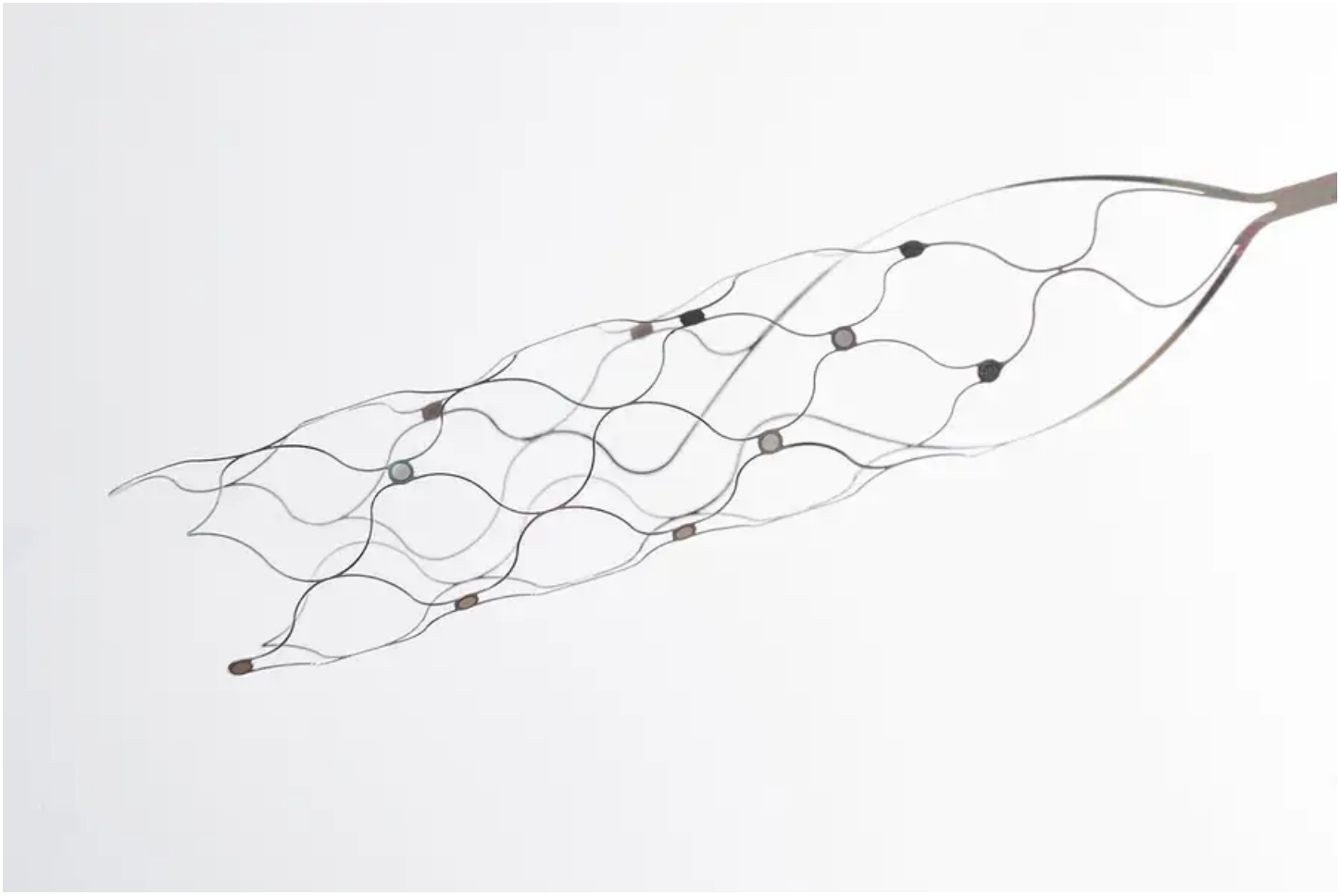
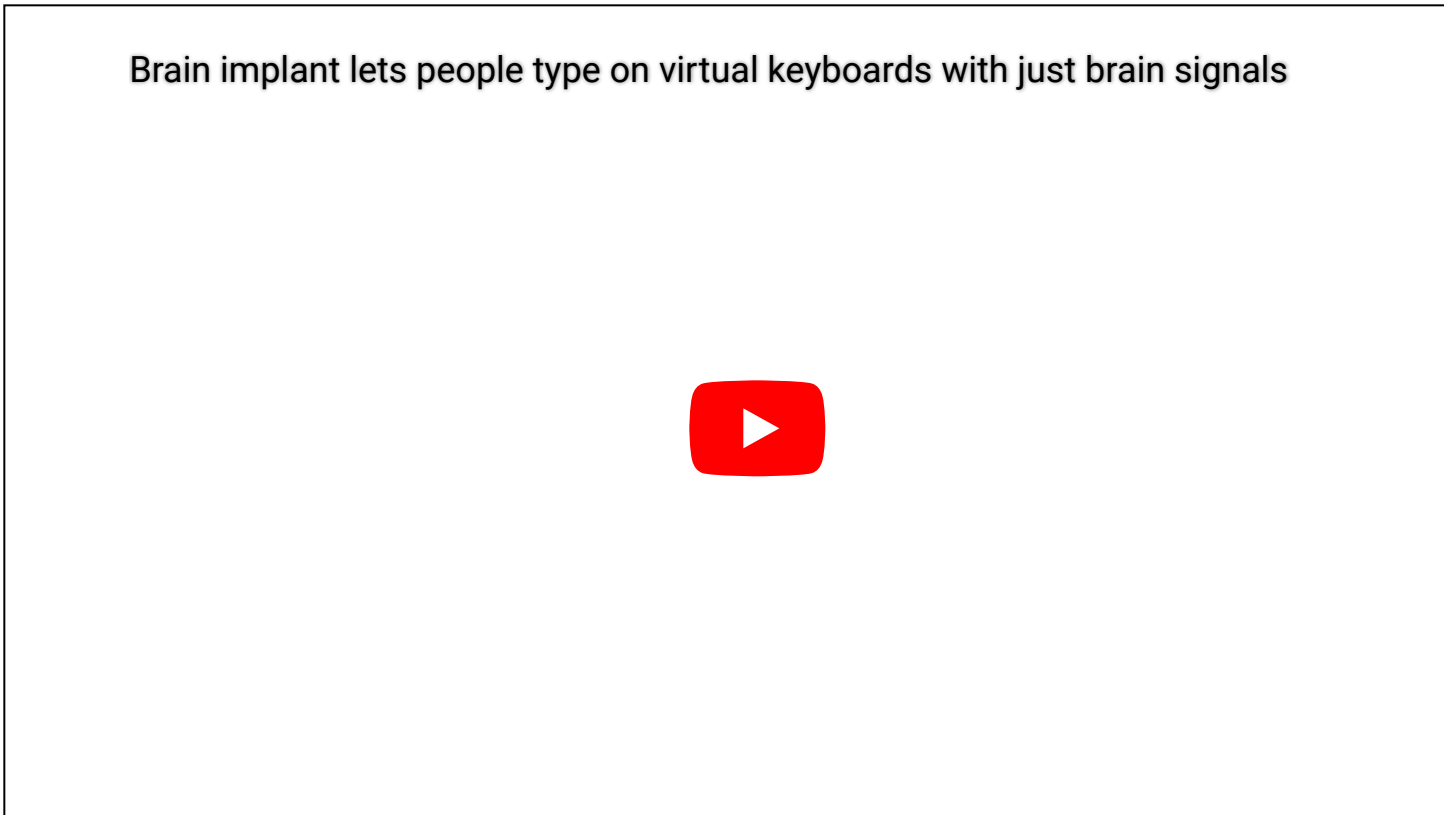


The "Stentrode" brain implant
Synchron

Rodney Gorham, a 63-year-old Australian, has always been a music fan. In a recent WhatsApp conversation with *New Scientist*, he shared his thoughts on his most memorable live event – "AC/DC in their prime". But more remarkable than that concert is the implant that allows Gorham to communicate even though he has amyotrophic lateral sclerosis (ALS), which has paralysed much of his body and left him unable to speak.

The race to commercialise brain-computer interfaces (BCIs) is gathering pace, and one company – Synchron – is leading the way. Backed by investments from Bill Gates and Jeff Bezos, the Brooklyn-based firm beat competitors in winning regulatory approval from the US Food and Drug Administration to conduct clinical trials in 2021. Gorham was one of the first volunteers in the world to receive a Synchron brain implant, an experience he described in the WhatsApp conversation as "exciting".



To type out such words, Gorham focuses his thoughts on moving certain muscles in both ankles. Although he has extremely limited mobility in his legs and arms, his brain implant detects the brain signals as he attempts to move the muscles, uses computer algorithms to interpret them, and then performs the equivalent of a tapping action on a touchscreen device. When combined with an external eye-tracking system to move the computer cursor, he can digitally tap a desired letter on an on-screen keyboard – although typing out a short phrase can take several minutes.

Synchron has been testing its technology in two clinical trials. One, called SWITCH, involves four volunteers in Australia, including Gorham; the second, called COMMAND, involves five volunteers in the US. Collectively, the trials aim to demonstrate how the brain implant can empower people with paralysis to send texts or emails, do online shopping or banking, control smart home devices such as smart thermostats, or simply ask caregivers for help.

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Other startups such as Elon Musk's Neuralink have joined the race to commercialise BCIs. But Synchron's approach differs from theirs. "There seems to be a feeling in the community that BCI is this tech race to augment the human body," says Tom Oxley, CEO and founder of Synchron. "That's not what needs to happen for the technology to get approved – it needs to first deal with a medical condition that someone has."

Synchron has also shunned invasive, open-skull surgeries for brain implants. Instead, the company uses a less invasive procedure that inserts a special electrode array – a "Stentrode" – into a blood vessel. This is achieved through surgery to the jugular vein, allowing access to a blood vessel near the brain's motor cortex, which controls muscle movements.

Oxley says this minimises the risk of complications such as infections to ensure "longevity and stability" for the brain implant. Synchron has already shown that the device can operate reliably and safely in a year-long study of the four recipients in the SWITCH trial. It is now working with them to demonstrate that commands can be consistently and reliably performed.

There is, however, a downside to placing the implant inside blood vessels: The device's electrodes do not have direct access to the brain's neurons. Interpreting brain signals in this way is somewhat like trying to listen in on a conversation happening inside a room while standing outside the door, says Kip Ludwig at the University of Wisconsin-Madison. To overcome this limitation, Synchron's engineers have developed algorithms that can interpret poorer-quality brain signals.

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Synchron is now preparing for a third clinical trial to demonstrate how the implant can help recipients reliably perform specific functions. If the trial is successful, Synchron plans to make it commercially available. The company's first target market is the approximately five million people whose arm paralysis leaves them unable to manipulate a smartphone or tablet.

However, Ludwig cautions that the brain implant will need to demonstrate a wider range of command capabilities than what has been reported so far to prove useful for people with less severe physical limitations. For example, the four recipients in Australia were typing an average of 16 characters per minute with about 93 per cent accuracy as of last year. That is "better than zero", but "it's not a grand slam home run that would suddenly mean people with much less severe motor deficits would be willing to get the procedure", says Ludwig.

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To get beyond the "science experiment" stage, any brain implant must show the potential to "significantly alter quality of life or quality of care for our patients", says David Putrino at Mount Sinai hospital in New York, who is overseeing part of the COMMAND clinical trial in the US.

However, if Synchron can successfully deploy an affordable and reliable device for home use, it could also jumpstart a market for other brain-computer interface companies, says Nick Ramsey at the University of Utrecht in the Netherlands. It is "a simple system which

people can actually use in daily life", says Ramsey. "That's what I very much appreciate about it."

Gorham, too, has words of praise for Synchron's technology. "It will save a lot of people who want to communicate with with [sic] the outside world."

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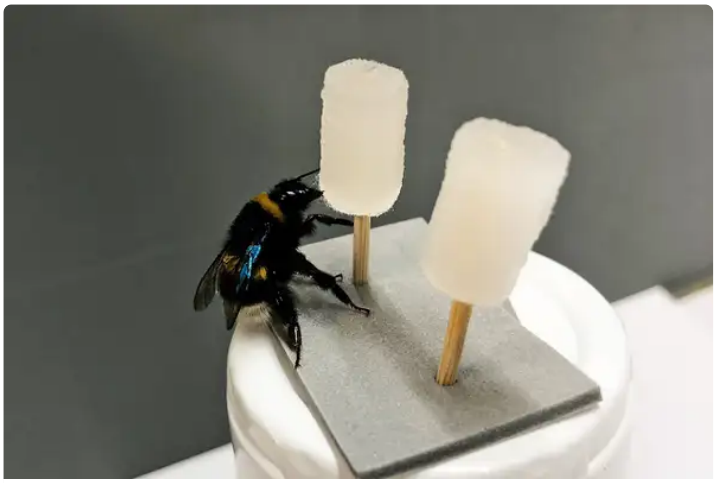

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